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CONFERENCE TITLE: Smart Structures and Integrated Systems (ss03)
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ABSTRACT TITLE: System modeling of Rotary Ultrasonic Motors
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ABSTRACT TEXT: Piezoelectric transducers arranged in a controlled configuration can be used to produce a variety of actuation mechanisms, where rotary and linear motors are some of the examples. Such devices have attractive characteristics that made them ~~emerged~~ emerge commercially in such products as cameras and are now approaching a maturity that makes them suitable ~~considered~~ for space and planetary applications. The reported actuators are showing efficiency levels in the range of 20 to 30% and it is desirable to reach as high level as possible to bring these motors to the point of making them the preferred choice in motors. Such a goal can be reached by the use of an accurate modeling of these devices, which involve solving nonlinear equations to support the design of such motors. The analysis of the motors operation is complex and requires a system treatment that include: equivalent circuit that represent the transition of the electrical signals to elastic vibration, force transfer thru a compliant interface, stator/rotor interaction, complex geometry, etc. These issues have been studied by the authors, were a finite element model was developed and elements of the model were corroborated experimentally. The model incorporates the various components and the complex geometrical configuration to predict the excitation frequency and modal response of an annular stator. An effective USM was developed using the results of the model, where the details of the stator were used in the design including the teeth, piezoelectric crystals, stator geometry, etc.

KEY WORDS: Ultrasonic Motors (USM), Stators and Rotors, Actuators, Active Materials, cryovac operation.

BRIEF BIOGRAPHY: Dr. Yoseph Bar-Cohen is a physicist with over 27 years experience in NDE, sensors, actuators and electroactive materials. He is the Jet Propulsion Lab (JPL) Resident NDE expert and the Group Leader for the NDE& Advanced Actuators (NDEAA) Technologies. Also, he is an Adjunct Professor at the Department of the Mechanical and Aerospace Engineering, the University of California, Los Angeles (UCLA), a Fellow of the American Society for NDT (ASNT) and Chair of the ASNT's Ultrasonic Committee. Dr. Bar-Cohen discovered the leaky Lamb waves and the polar backscattering in composite materials and co-pioneered their applications to NDE. He is the author of more than 135 publications, made numerous presentations at national and international symposia and holds many patents.